SEARCH: Southeastern Aerosol Research and Characterization

New as well as proven measurement technologies combine to establish a detailed aerosol climatology for the Southeast.

Background

On successive days in July 1997 President Clinton issued a directive for a common-sense implementation strategy and EPA revised the national ambient air quality standards for ground-level ozone and particulate matter. EPA's action created a new standard for fine particulate matter ($PM_{2.5}$) and set its levels at 15 micrograms per cubic meter ($\mu g/m^3$) for an annual average (averaged over 3 years) and 65 $\mu g/m^3$ for a daily average (3-year average of the 98th percentile daily average). Analysis of the very limited existing data suggests that the new $PM_{2.5}$ standard will be more difficult to achieve than the older PM_{10} standard and will increase the number of PM nonattainment areas.

Unlike other criteria pollutants such as ozone, fine particles typically represent mixtures of hundreds of compounds. Therefore, in order to identify sources of $PM_{2.5}$ and to attribute health effects to specific components, we must measure $PM_{2.5}$ composition as well as its mass.

Consistent with the July 1997 Presidential directive, EPA will not require control of $PM_{2.5}$ precursors until after EPA has conducted further scientific review of the $PM_{2.5}$ standards and EPA officially designates areas as nonattainment for the pollutant. Such designation is expected in the 2004 to 2005 time frame. State implementation plans (SIPs) must be submitted within three years of the EPA attainment designation.

Given this ambitious schedule, EPA is leading the states in a massive monitoring program to characterize the chemical and physical nature and geographical extent of $PM_{2.5}$. A nationwide network consisting of more than 1500 monitoring sites is scheduled to be fully operational by January 2000. A small subset of these (the "speciation network") will be devoted to detailed compositional measurements. EPA is also planning to undertake other major $PM_{2.5}$ characterization experiments (e.g., "supersites") starting in 1999. EPRI has been advising EPA on the design and implementation of this program, and a dialogue has been established to coordinate public and private sector efforts.

The Inception of SEARCH

From the outset, it has been clear that the public sector effort would benefit from private sector collaboration in producing sufficient high quality and timely data. For instance, data from the Federal Reference Method (FRM) is subject to potential bias and would be insufficient for $PM_{2.5}$ source allocation. Therefore, Southern Company and EPRI have taken

the initiative to deploy instrumentation designed to minimize measurement biases (e.g., see Figure 1) that will characterize aerosols over a broad geographical region of the Southeast on a rapid time track. Building on the existing SCION component of the Southern Oxidants Study, they have established an eight-station network in a four-state area. A network map is shown in Figure 2. Several of the sites in Figure 1 are, or soon will be, operated in collaboration with State or local air monitoring networks. In addition, the Jefferson Street site is the focal point of a major epidemiological study in the City of Atlanta (see ARIES Fact Sheet).

SEARCH's Objectives

To work interactively with the States and to assist them in

meeting their $PM_{2.5}$ monitoring obligations and

gathering a data set appropriate for evaluating and applying (as in SIP development) air quality models.

2) To provide an ambient data set with minimal sample adulteration and of sufficient breadth, in terms of the number of measured variables, their geographical diversity and extent, the frequency with which they are measured, and the duration

of the measurement campaign that:

a PM and oxidant climatology for the region will be established,

coarse and fine PM atmospheric loadings will be distinguished,

chemical constituents of PM and their physical states will be characterized and correlations among precursor and product materials in the atmosphere will be determined, allowing hypotheses regarding pollutant sources to be tested,

insights into aerosol formation mechanisms can be gained,

differences between airborne materials in coastal and inland, and rural and urban areas will be documented, and

biases in measurement methods, such as use of a single teflon filter in the Federal Reference Method for $PM_{2.5}$, will be characterized.

3) To develop reliable continuous methods in order to understand $PM_{2.5}$ formation mechanisms and to replace selected ones now requiring discrete sampling followed by laboratory analysis.

SEARCH at a Glance

Funding

Approximately $6,000,000 from 1998 to 2001

Monitoring Stations

8, arranged in 4 urban-rural pairs in each of GA, AL, MS, and FL . See Tables 1 and 2 for measured variables.

Sponsors

Southern Company

EPRI

Oglethorpe Power

Detroit Edison

Alabama Electric Cooperative

Who to Contact

Sponsors' Project Manager

Alan Hansen, EPRI, 650-855-2738

ahansen@epri.com

Contractors

Atmospheric Research & Analysis (ARA)

Chester LabNet

Desert Research Institute

QST Environmental

Collaborators

Southern Oxidants Study

- ***Southern Center for the Integrated Study of Secondary Air Pollutants***

Aerosol Research Inhalation Epidemiological Study

- ***Alabama Department of Environmental Management***
- ***Assessment of Spatial Aerosol Composition in Atlanta (ASACA)***
- ***Florida Department of Environmental Protection***
- ***Georgia Environmental Protection Division***
- ***Georgia Institute of Technology***

Jefferson County Department of Health

Mississippi Department of Environmental Quality

Operational Details

Eric Edgerton, ARA, 919-402-9381

ericedge@gte.net

Table 1. SEARCH Continuous Gas and Particle Measurements

(1-min. to 60-min. averages)

Site	$PM_{2.5}$ Mass[8]	O_3	NO, NO_2 7 & NOy	HNO_3 & NH_3 6	SO_2	CO	Part. Size [1]	$PM_{2.5}$ Comp. [2]	Surface Met.[3]
Yorkville, GA	x	x	x	x	x	x		x	x
Jefferson St., ATL	x[4]	x	x	x	x	x	x	x[5]	x
Centreville, AL[9]	x	x[4]	x	x	x	x		x	x
N. Birmingham, AL	x[4]	x							
NAS, Pensacola., FL	x	x	x	x	x	x		x	x
Pensacola, FL		x[4]	x	x	x	x			
Oak Grove, MS	x	x							
Gulfport-Biloxi, MS	x	x4							

[1] Includes particle number and volume in 20+ size classes ranging from 3 nanometers to 3 microns aerodynamic diameter, provided through collaborations with ARIES.

[2] Composition includes organic carbon, elemental carbon, nitrate, ammonium and sulfate (under development; to be deployed during 1999).

[3] Meteorological variables include WS, WD, T, RH, solar radiation, barometric pressure and precipitation.

[4] Provided through collaboration with GA Tech, Jefferson County Department of Health, FL Department of Environmental Protection, and MS Department of Environmental Quality.

[5] May be deployed as portable set to other sites in later years (e.g., Oak Grove and N. Birmingham).

[6] HNO3 currently deployed, NH3 deployment expected in 1999.

[7] NO2 measured via UV photolysis.

[8] Measured with a TEOM, aspirated at ambient temperature and controlled relative humidity.

[9] Light scattering and absorption also measured continuously at Centreville.

Table 2. SEARCH Integrated Measurements[6]

(24-hour average)

Site	FRM Mass	PM2.5[1] Comp.	PM10[2] Comp.	Pollen, Mold[3]	H_3O^+, NH_3[4]	VOCs[5]
Yorkville, GA	x	x	x			
Jefferson St., ATL	x	x	x	x	x	x
Centreville, AL	x	x	x			
N. Birmingham, AL	x	x	x			
NAS, Pensacola, FL	x	x	x			
Pensacola, FL	x	x	x			
Oak Grove, MS	x	x				
Gulfport-Biloxi, MS	x[7]	x				

[1] $PM_{2.5}$ composition measurements include: mass, $SO_4^=$, NO_3^-, NH_4^+, trace elements, total OC and EC and three solvent-extractable fractions of OC and SVOC.

[2] PM_{10} composition measurements (dichot) include: mass, $SO_4^=$, NO_3^-, NH_4^+, and trace elements

[3] Burkard sampler

[4] HEADS sampler

[5] Canister sample analyzed for 60+ compounds.

[6] Samples collected every third in 1998, daily through 1999, and every sixth day through 2000-2001.

[7] Provided through collaboration with MS Department of Environmental Quality.